

What is claimed is:

1. A manufacturing method of a semiconductor device comprising the steps of:

5 forming an insulating film over a semiconductor substrate;

exciting a plasma of a gas having a molecular structure in which hydrogen and nitrogen are bonded and irradiating the plasma onto the insulating film;

10 forming a self-orientation layer made of substance having a self-orientation characteristic on the insulating film; and

forming a first conductive film made of conductive substance having the self-orientation characteristic on the self-orientation layer.

15 2. A manufacturing method of a semiconductor device according to claim 1, wherein the gas is an ammonia gas.

3. A manufacturing method of a semiconductor device according to claim 1, wherein, after the plasma is irradiated onto the insulating film, the self-orientation layer is formed on the insulating film while  
20 maintaining a state that the insulating film is put in a vacuum atmosphere.

4. A manufacturing method of a semiconductor device according to claim 3, wherein a pressure of the vacuum  
25 atmosphere is set to  $1 \times 10^{-3}$  Torr or less.

5. A manufacturing method of a semiconductor device according to claim 1, wherein a surface of the insulating

film is dehydrated after the plasma is irradiated onto the insulating film and before the self-orientation layer is formed.

5       6. A manufacturing method of a semiconductor device according to claim 5, wherein removal of a moisture is executed by coating alcohol on the first conductive film.

7. A manufacturing method of a semiconductor device according to claim 1, wherein the self-orientation layer is formed of any one of titanium, aluminum, silicon,  
10       copper, tantalum, tantalum nitride, iridium, iridium oxide, and platinum.

8. A manufacturing method of a semiconductor device according to claim 1, wherein the first conductive film is formed of any one of titanium, aluminum, silicon,  
15       copper, tantalum, tantalum nitride, iridium, iridium oxide, and platinum.

9. A manufacturing method of a semiconductor device according to claim 1, wherein the first conductive film is formed by any one of a sputter method, a plasma CVD method, an MOCVD method, and a plating method.  
20

10. A manufacturing method of a semiconductor device according to claim 1, further comprising the step of forming a conductive pattern by patterning the first conductive film and the self-orientation layer.

25       11. A manufacturing method of a semiconductor device according to claim 10, wherein the conductive pattern is any one of an electrode and a wiring.

12. A manufacturing method of a semiconductor device according to claim 10, further comprising the step of:

5       forming a hole under a part of the insulating film in a region in which the conductive pattern is to be formed, and forming a conductive plug in the hole before the plasma is irradiated onto the insulating film.

13. A manufacturing method of a semiconductor device according to claim 10, wherein an island-like oxygen barrier metal that is exposed from the insulating film is formed on a part of the region in which the conductive pattern is to be formed, and a conductive plug is formed under the oxygen barrier metal.

14. A manufacturing method of a semiconductor device according to claim 1, further comprising the steps of:

      forming a capacitor lower electrode on the conductive plug and a peripheral area by patterning the self-orientation layer and the first conductive film;

20       forming sequentially an oxidation-preventing insulating film and an adhesive insulating film on the capacitor lower electrode and the insulating film;

      polishing the adhesive insulating film and the oxidation-preventing insulating film to expose an upper surface of the capacitor lower electrode;

25       forming an overlying conductive film made of a same material as the first conductive film on the adhesive

insulating film, the oxidation-preventing insulating film,  
and the capacitor lower electrode;

forming a ferroelectric film on the overlying  
conductive film;

5 forming a second conductive film on the  
ferroelectric film; and

10 patterning the second conductive film, the  
ferroelectric film, and the overlying conductive film to  
form a capacitor shape that coincides with the capacitor  
lower electrode.

15 15. A manufacturing method of semiconductor device  
according to claim 1, further comprising the steps of:

forming a ferroelectric film on the first  
conductive film;

15 forming a second conductive film on the  
ferroelectric film;

forming a capacitor upper electrode by patterning  
the second conductive film;

20 patterning the ferroelectric film to leave at least  
under the capacitor upper electrode; and

forming the capacitor lower electrode at least  
below the capacitor upper electrode by patterning the  
first conductive film and the self-orientation layer.

25 16. A manufacturing method of a semiconductor  
device according to claim 14, further comprising the  
steps of:

crystallizing the ferroelectric film by a heat in

an oxygen atmosphere after the ferroelectric film is formed; and

annealing the ferroelectric film via the second conductive film by the heat in the oxygen atmosphere after the second conductive film is formed.

17. A manufacturing method of a semiconductor device according to claim 14, wherein the second conductive film has two steps of forming a lower conductive film and an forming upper conductive film, and further comprising the step of:

annealing the ferroelectric film in an oxygen atmosphere before and after formation of the lower conductive film respectively.

18. A manufacturing method of a semiconductor device according to claim 14, wherein the ferroelectric film is formed of either PZT or PZT into which at least one of calcium, strontium, and lanthanum is doped.

19. A manufacturing method of a semiconductor device according to claim 14, wherein the ferroelectric film is formed by any one of a spin-on method, a sol-gel method, a MOD method, and a MOCVD method.

20. A manufacturing method of a semiconductor device according to claim 19, wherein, when the ferroelectric film is formed by the MOCVD method, a substrate temperature is set to 600 to 650 °C.

21. A manufacturing method of a semiconductor device according to claim 20, wherein more than 90 % of

grains constituting the ferroelectric film have a (111) orientation.